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Fresh Water Sponges and Particularly Those of the United States.

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In the beginner's class of Zoology there is invariably noticed a doubting expression of surprise when it is announced that the next subject to study is the Fresh Water Sponge. I fancy I can see the same expression on the face of those of my readers who may doubt that sponges are found in the nearby brook, river or lake. To be sure, such sponges as the average man knows about, and which he can buy in the nearby drug store, are not to be looked for in our ponds and ditches; they must be sought in the far away Mediterranean Sea or down on the coasts of the Bahamas or on the Keys south of Florida.

There are many kinds of sponges — just as there are many kinds of roses or violets. This comparison reminds me also of the necessity of stating that sponges are not vegetable growths, as was once believed even by all the scientists and is still believed by many otherwise well educated people. It was in the middle of the 19th Century that it became definitely settled that sponges belong to the animal kingdom. They are now very often placed by themselves into a proper phylum called Porifera though some had placed them formerly with the Protozoa as compound Choanoflagellata, and many at present associate them with the phylum Coelenterata. Very little attention is to be paid at present to the various systems of classifications in vogue. They are all transient and provisional, and this is the most annoying condition of Zoology to the beginner. He takes up one text-book after another and he finds in each a different system of classification; and it is wise in the part of the teacher to show him from the beginning, that classification of animals is not after all the important

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work of the Zoologist, the important thing in a man's library is not where his books are placed—provided he knows what they contain. It would be loss of time for me to enter here upon a discussion of the various systems of classification with reference to the Porifera, whether it should be natural or artificial; phylogenetic or morphological is of no consequence for the moment. Those of my readers that want this kind of thing can find it in the classical works of Bowerbank, Oscar Schmidt, Zittel, Gray, Carter, Hæckel and Vosmaer. For my part I believe that Professor James Hornell, of the Jersey Marine Biological Station, has chosen the form of classification best adapted to my purpose: In Vol. I., No. 2, February, 1894, of "The Journal of Marine Zoology and Microscopy" page 39, he formulated the following system:

PHYLUM:—PORIFERA.

Branch A, *Calcarea*	Branch B, *Non-Calcarea*
Family I.—Asconidae.	Class I.—(Skeleton siliceous) Silicispongiae.
" II.—Syconidae.	Order I.—Monaxonida.
" III.—Leuconidae.	" II.—Tetractinellida.
(Characterized respectively by the Canal system indicated by the name.)	" III.—Hexactinellida.
	Class II.—(Skeleton fibrous) Ceratosa.
	Class III.—(Skeleton none) Myxospongiae.

The Calcarea are recognized by the chemical composition of their so-called skeleton. This skeleton is in the form of needles and spines of various forms, but invariably their animal matter is highly or almost completely impregnated with calcium carbonate, and can easily be verified by subjecting them to any mineral acid, which will disolve them with effervescence. They are all marine and therefore do not concern us in this study.

The non-Calcarea include, as may be seen from the table above, three kinds or classes. In the first class are included all sponges that have spicules of a siliceous or glassy composition. In the second, we find those sponges whose skeleton consists of a horny fibrous network, (sponge of commerce), and the third class includes those that have no skeleton and wholly consist of soft animal matter.

The reader will notice that the siliceous sponges are sub-divided into three orders and these orders are again based on the form of the spicules. In the first order the glassy needles are simple rods or needles. In the second the spicules consist of four needles

radiating from one point and in the third order the radiating needles are six. Now comes the all important question in this study. Where shall we place the Fresh Water Sponges? If we follow Hornell's classification the question is simple. In all Fresh Water Sponges the spicules are siliceous and of the monaxial type, and so they must belong to the class of Silicispongiae and to the order of Monaxonida.

Vosmaer places the Fresh Water Sponges into the third order of the Non-Calcarea which he calls Cornacuspongiae; and he gives the following diagnosis: "Skelet besteht entweder aus, vorwiegend, monaxilen Spicula, welche durch mehr oder weniger spongin zusammengekittet sind, oder nur aus spongin mit oder ohne Vestärkung von Fremdkörpern. Leben in See,—brackischem und Süss-wasser meist nicht sehr tief." Translated this means that in the Cornacuspongiae "the skeleton consists principally of monaxial spicules which are cemented together more or less by spongin, or the skeleton consists merely of spongin with or without strenghtening of foreign bodies. They are found in salt water—brackish water—or in fresh water and not at great depths." Thus we see that Vosmaer places the Fresh-Water Sponges in the same group as the ordinary commercial sponges which are all marine; he however separates them from each other by creating two sub-orders viz.: the *Halichondrina*, in which the fresh-water sponges are found forming the second family called Spongillidae, and the *Ceratina* which include the commercial sponges as Family two, viz.: Spongidae.

I need scarcely say here that the prospective student will find no difficulty whatever in identifying the Fresh Water Sponges. Fresh Water Sponges properly so called are only found, as a matter of fact, in fresh water, all other sponges are found in the sea, and so whenever a sponge grows in fresh water one need have no fear of making a mistake as to identity. Let this be the guide for the beginner and after he has found a few Fresh-Water Sponges and studied them with the low power or high power of the compound microscope he will gain the knowledge to distinguish them from marine forms. There are difficulties in the study. There are so many things growing in fresh water, but one should not be discouraged, for the matter is not as difficult as it seems. First one must get over the idea that everything green in the water must be a plant—an alga or some moss. The former one will at once reject when one sees that it consists of simple or branching green threads and the latter has small green leaves which even one-inch hand lens will make plain. All one needs in the field is a hand lens of one inch

focus and one cannot go wrong. Of course, the first question naturally is: "Where shall I look for them, and how can I tell when I have found a Fresh Water Sponge?"

One will soon find that many of the troubles are imaginary ones, as to my own surprise I found them more readily than I had expected, and having found them, I knew they were what I was looking for in spite of the difficulties I had anticipated.

It was in the middle of September many years ago that I set out for the banks of the St. Joseph River in Northern Indiana. The banks were steep and some old stumps of trees were scattered along the shore, with their twisted roots reaching out in all directions. I soon noticed in the swift current that on some of the roots were greenish looking tufts—I secured a few of them, and hardly had I touched them, when I knew I had found what I had been looking for. The sponge mass is not the same as Cladophora. One will know it at once and will never forget it. Under the hand lens one will see the little needle-like spicules sticking out in all directions, but more than this in the interior of the mass one notices the small round globules, so characteristic of the Fresh Water Sponges. These globules are the gemmules and whenever these small globules are found in a greenish mass one may be sure that the specimen is a sponge. It is needless to look for sponges in the spring time, but one will never fail to find them later in the year and especially in August and September.

These gemmules are bodies peculiar to Fresh Water Sponges, and have never been found in salt water forms. They are known in the literature of sponges as: Ovaria, gemmules, statoblasts, statospheres, sphaerules, etc., but at present the term "gemmules" is mostly used. I stated above that one must look for greenish masses, but this must not be taken to mean that the color is always green; the fact is they are often brown, gray and white according as they are more or less exposed to the light. Though a few have been found in muddy localities, they must, however, as a rule be sought in clear, pure and rapidly running water. A favorite locality is in shallow water of rivers, and they grow on loose stones, but one seldom fails to find them on rocks, timber, or loose boards at the end of a mill race or fall, or on the lining board and casings of sluice-ways. They should never be looked for in shallow waters that have a muddy bottom.

Sometimes they may be found on plants growing in lakes and they will spread over these plants like a thick cobweb or cushion. A long pole with a scraper attached to the end in connection with

a bag made of netting can be used advantagously in bringing them up from timber as piles driven into the rivers near dams etc. Sometimes a mill race is emptied for repairs or a reservoir of water works for the purpose of cleaning, and then is the time to search for sponges among the rocks and timber.

Always collect them preferably from timber as they can more easily be removed by slicing off chips or splinters and they are secured without too much injury. The gemmules which are deep within will not be lost.

Young sponges such as are collected late in Spring or early in Summer will not have gemmules and, although useful to collect at all seasons, yet if for the purpose of determining the genus and species they must be collected not earlier than July. If the student's purpose is only to gather them as a collector, then he may transfer them directly into 50 per cent. alcohol or better 35 per cent. and when he gets home after some hours transfer them to stronger alcohol. Others may be placed in shady places to dry, and to prevent decay, they should be turned over at short intervals. In no case should they be left in water for any length of time as they will rapidly decay. If one wishes to study their life action they must be transferred as quickly as possible to shallow glass dishes. To demonstrate the circulation of water through the sponge mass a solution of carmine is made in pure water. After having placed the fresh living sponge into a suitable dish and covered well with water a small amount of the carmine solution is taken up with the pipette and gently emptied over one part of the sponge—soon the carmine colored water will be seen to disappear into the mass drawn in by a suction movement, and shortly after the carmine colored water will be seen to be ejected like diminutive clouds from minute chimney-like structures. This circulation is caused by the flagellated cells that line the canals in the mass. One can also watch the development of the gemmules by securing eight or ten of them and place them in a shallow watch glass with water, and cover them with a piece of glass to prevent evaporation—should this take place to some extent, one can easily add with a pipette very gently some pure water. The watch glass is placed near a window not too much lighted, and in a few days the growth can be examined under a compound microscope with a three-quarter inch lens, or with a water immersion lens of a higher power.

The student may take some of the fresh material and place a bit of it on a slide and examine it, but he will find that a bit of thoroughly dried material mounted directly into Canada balsam

will prove more satisfactory. If he has the conveniences of a biological laboratory at his disposal, he will want to make sections, and this does not present difficulties that would prove unsurmountable. A bit of the alcohol specimen may be stained with borax carmine and imbedded in celloidin and good sections may be made with an old microtome blade. The siliceous or glassy spicules will certainly spoil somewhat his best knife, but then in every laboratory there are a few knives reserved for just such kind of work. I have even made fair free hand sections of the gemmules, that will show the arrangement of the birotulate spicules which form the rather thick wall of these objects.

In examining a bit of sponge under the microscope, we will at once notice two structures viz., the skeleton part and the sarcode or fleshy part. The fleshy portion is supported by a siliceous framework made up of fine delicate, needle-like spicules—these spicules are about one-hundredth of an inch in length and pointed at both ends as a rule; in some species the spicules will be found to be covered by minute pointed projections and giving them a thorny appearance. The shape, size and appearance of these spicules help to determine the species. Besides these skeletal spicules there are others somewhat different in appearance and they are found in the dermal layer and hence called "dermal spicules." In the walls of the gemmules are found a third kind of spicules called "birotulates," these are somewhat of the shape of dumb-bells, but the ends instead of being knobs are either circular disks, or toothed disks or even a circle of kooklets. These birotulates are very important in classification. Carter selected them as the basis for the diagnosis of the genera of Spongillidae.

In order to determine the genus and species of any Fresh Water Sponge, there should be made four microscopic preparations:

The first is to examine a small piece of the dried sponge mounted directly in balsam.

The second is a similar preparation of the dermal portion to study shape and form, presence or absence of dermal spicules.

The third preparation consists of the gemmules for examination both in their normal state and in a cleared preparation. This latter preparation is made by placing a mass containing eight or ten gemmules on a slide and applying some hot nitric acid to it—this will remove most of the sarcode. Care is to be taken not to leave the acid too long as it will also attack the chitin of the spicules. After the acid has acted for a time, it may be washed out a number of times by applying alcohol and then absolute alcohol, xylol and finally mount in balsam.

The fourth and last preparation needed is easily made and it is done by the general method of cleaning diatoms—polycystina or sponge spicules. Take a test tube and put into it some of the material, add some nitric acid and boil gently over flame. After the material is completely disintegrated add water to fill the test tube, and set aside for an hour and the spicules will settle to the bottom, where they will form a sediment. Pour off carefully or with a long pipette, remove the water without disturbing the sediment. Wash thus several times to remove acid, alcohol may be used the third time as it hastens the next process.

Take with a pipette a small quantity of the sediment and place a drop of it on the middle of a clean slide. Let it dry completely and pass the slide through a flame. Finally put on the balsam and cover and you have a permanent preparation of all kinds of spicules contained in the sponge.

There remains for me only to note here all the species that have been so far observed in North America, I shall enumerate first all the genera so far observed in the whole world, secondly, I shall give the number of species belonging to each genus, and mention all the North American species in each genus. An abreviated and slightly modified key to the Genera of Fresh Water Sponges according to Potts–Carter System may be stated as follows:

A Fresh Water Sponges with gemmules.

I. Gemmules with arotulate spicules.

1. Gemmules surrounded by simple thorned spicules which are pointed or rounded at ends. . SPONGILLA.

II. Gemmules with birotulate spicules.

1. Birotulate spicules of one class or type and rotules equal or nearly so. . . . . MEYENIA.

2. Birotulate spicules of two classes or types—the smaller number of them longer and rotules hooked. HETEROMEYENIA.

3. Birotulate spicules with rotules unequal. . TUBELLA.

III. Gemmules with unirotulate spicules.

1. Spicules forming capsule of gemmules with only one rotule other end merely pointed. . . . . PARMULA.

IV. Birotulate spicules of no consequence. The foraminal tubules of the gemmules more or less prolonged and terminating in a funnel-like expansion or divided into thread-like appendages varying in length and number. . . . . CARTERIUS.

B. Fresh Water Sponges in which gemmules have not been found.

Provisionally there are three genera:

Uruguaya, *Lubomirskia* and *Potamolepis*.

Of these nine genera of Fresh Water Sponges the following five are represented in North America: Spongilla, Meyenia, Heteromeyenia, Tubella, and Carterius.

Parmula with three species has thus far only been reported from South America.

Uruguaya with one species is reported from the rapids of the River Uruguay, near the town of Salto.

Lubomirskia with four species has only been reported from Lake Baikal, Central Asia.

Potamolepis with three species has only been reported from the Congo River, Africa.

We may now proceed to the study of the North American species of the five remaining genera.

I. Genus *Spongilla* Lamarck, 1815.

It is well known that the ancient authors placed all the Fresh Water Sponges into the genus Spongilla, and Mr. Potts claims that Carter is the founder of the genus as it stands to-day; he says on page 182 of his Monograph, "When the old genus *Spongilla* of authors was subdivided by Mr. Carter in 1881, this term was very appropriately restricted to that type which includes the species most widely diffused and most frequently noticed throughout the world." Therefore the genus may read:

Genus, *Spongilla*, Carter. 1881.

Under this genus Potts enumerates 17 species some of which exhibit varieties.

Among these species five are North American, viz.:

1. *S. aspinosa*. Potts.
   Loc. New Jersey swamps.
2. *S. lacustris*. Linn. Widely known as the commonest F. W. Sponge. He gives the following varities: *paupercula*, *lawsoni*, *abortiva*, *montana*, *multiforis and lehighensis*.
3. *S. fragilis*, Leidy. This is reported from many localities in U. S. A., and it has many varieties. One variety called calumeti; Thomas, is reported from the Calumet River, near Chicago.
4. *S. mackayi*, Carter, from Nova Scotia.
5. *S. terrae-novae*, Potts, from Newfoundland.

II. Genus, *Meyenia*, Carter, 1881.

This genus includes 17 species not counting a number of varieties. Seven of the species are North American.

1. *M. leidyi*, Carter, so far only found at Philadelphia and in New Jersey.
2. *M. fluviatilis*, (*Spongilla fluviatilis*, of authors) found in all parts of U. S. and in many varities.
3. *M. robusta*, Potts, from California.
4. *M. millsii*, Potts, from Florida.
5. *M. subdivisa*, Potts, from Florida.
6. *M. baileyi*, Bowerbank. West Point, N. Y.
7. *M. crateriformis*, Potts. Pennsylvania.
8. *M. everettii*, Mills. Gilder Pond, Mt. Everett, Mass.

III. Genus, *Heteromeyenia*, Potts, 1881.

In this genus Potts enumerates four species with a few varieties, all of which are only so far reported from the U. S. A.

1. *H. repens*, Potts, reported from Lehigh Gap, Pa., Lake Hopatcong, New Jersey, and along the Eastern Coast.
2. *H. argyrosperma*, Potts, from Lehigh Gap, Pa., New Jersey, and New England States.
3. *H. longistylis*, Mills. Sponge unknown but gemmules collected by Dr. Wolle at Bethlehem, Pa.
4. *H. ryderi*, Potts. This sponge is reported from Florida to Nova Scotia and from Atlantic Coast to Iowa. I found it in St. Joseph River, Indiana.

IV. Genus. *Tubella*, Carter, 1881.

In this genus, we find five species, one of which is represented in U. S. A. The other four being found in the Amazon River of South America.

1. *T. pennsylvanica*, Potts. It is found in Lehigh River and generally throughout Eastern U. S.

V. Genus, *Carterius*, Potts 1881.

This genus contains four species, three of which are found in the United States of America. The fourth being found in Russia and in Bohemia, but Carter claims that the Russian species is identical with species *C. tenosperma* of America.

The American species are:

1. *C. tubisperma*, (*!*) Mills, and was found on timber in the Niagara River, N. Y., and also in a reservoir in Boston, Mass.

2. *C. latitenta*, (?) Potts, found in Chester Creek, Pa., and in Western New York.
3. *C. tenosperma*, (?) Potts. First found by Mr. Potts in a rill at the Centennial Fair Grounds, Philadelphia, and later in New Jersey.

In conclusion let me state that the principal object in writing this communication for the Midland Naturalist is to stimulate students in its territory in the study of Fresh Water Sponges; I would like to see all localities in its territory where any of the species are found, reported in these pages.

Bibliography. *Bowerbank*, Monograph of Spongillidae 1863.

Carter, History and Classification of the known species of Spongilla, 1881.

Potts. Fresh Water Sponges, A Monograph. Proceeddings of Academy of Natural Sciences, Philadelphia, 1887. This Monograph is indispensable for the study of American Fresh Water Sponges.

It covers the whole ground of Fresh Water Sponges and gives special facilities for the determination of all American species as far as known.

Vosmaer, Klassen und Ordnungen der Spongien. (Porifera) 2nd vol. of Bronn's, Klassen und Ordnungen des Thier-Reichs.

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Tentative List of Myxomycetes of Northern Indiana and Southern Michigan.

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The following list of the Myxomycetes of northern Indiana and southern Michigan represents only part of those actually observed in this locality, and only those species are mentioned which are at present found in the herbarium of the University. They were collected by Dr. J. A. Nieuwland of the botanical department of Notre Dame University, during the months of July and August in the year 1905. Favorable conditions for growth, warm weather followed by periodical rains, were prevalent at that time and many of the plants that were developed then have not been seen since.

Continued drought is extremely destructive to Myxomycetes as we had ample opportunity to observe last year. During 1909 not more than a dozen species were found in the same region and they were of the commonest kinds. These seem to develop under almost ordinary conditions. Among the few common slime-moulds that appeared last season are *Trichia varia*, *Arcyria denudata*, *Hemitrichia stipitata*, and *rubiformis*, *Fuligo ovata*, and *Lycogala epidendrum*. All of these developed in places that seem to produce such plants independently of periodic showers, as the localities are always moist, e. g. wet shady woods. Even *Fuligo ovata* was very scarce last season.

Whether the drought of 1908 will cause a larger crop of Myxomycetes to appear this coming season if rains are favorable remains to be seen. Many species that failed to develop may appear this year. In fact it was noticed that several forms are appearing unusually abundant and very early. *Lycogala epidendrum* one of the few that were found in 1908 was seen this year in a dry location on the University grounds in the interval of several warm days between two snow storms and this in spite of the fact that the season is very much backward. Two crops of the plants appeared about April 13 and April 20. The last crop coming out between two falls of snow. Snow enough to cover the ground appeared twice in fact since the last date. The plants were perfectly normal and healthy in spite of the cold. Some were fixed in chrom-acetic acid for later study while still in the plasmodial stage.

In 1905 Myxomycetes were found very abundantly in woods and fields free from trees, and even in marshes. A plasmodium of *Fuligo ovata* over a foot and a half square was found crawling over oak leaves which had been dumped into a marsh. The same plant was found coming up from the middle of a cinder-path in several places. Its presence here was quite puzzling until it was investigated. It was found to have come up from an oak stump under several inches of cinders through which the Fuligo crept to develop. Only a hundred yards away the same species was found on a dead poplar seven feet from the ground. Physarum cinereum usually appearing annually on the grass in the University lawn has for years taken at each reappearance the forms and configurations of the "fairy circles" of certain Basidiomycetes.

The words "common," "abundant;" etc., refer to the fact that other species were observed abundantly in nearby localities but duplicates were only collected from places at least two miles apart.

Arcyria pomiformis (Leers) Rost. 1875.
Found at Bankson Lake,
near Lawton, Mich., July 27, 1905

Arcyria incarnata Pers. 1791.
At Bankson Lake, July 25, 1905.

Arcyria ferruginea Sauter, 1841.
At Bankson Lake.
Very common. July 25, 1905.

Arcyria denudata (Linn.) Sheldon. 1895.
In Studebaker's Woods,
South Bend, Ind. July 10, 1905.
Also Bankson Lake.
Quite Common. July 27, 1905.

Arcyria digitata (Schw.) Rost. 1875.
Woods at end of Prairie
Ave., South Bend, Ind. July 10, 1905.
Also Bankson Lake. July 27, 1905.
Very Common and
abundant.

Arcyria cinerea (Bull.) Pers. 1801.
At Bankson Lake. July 27, 1905.
Also Studebakers's Woods. July 10, 1905.
Very common and
abundant everywhere.

Arcyria nutans (Bull.) Grev. 1824.
North of Bankson
Lake. Common. July 27, 1905.

Badhamia rubiginosa (Chev.) Rost. 1876.
At Bankson Lake. July 27, 1905.

Cribraria minutissima Schweinitz. 1832.
At Bankson Lake. July 27, 1905.
Also Studebaker's Woods.
Common but hard to find. July 10, 1905.

Cribraria dictydioides Cke. and Balf. 1881.
At St. José Park, Bankson
Lake. Very common. July 24, 1905.

Cribraria purpurea Schrad. 1797.
At Bankson Lake.
Very Common. July 25, 1905.

Cribraria splendens (Schrad.) Pers. 1801.
At Bankson Lake. July 27, 1905.

Ceratiomyxa fruticulosa (Muell.) Macbr. 1899.
In Studebaker's Woods.
Common everywhere. July 10, 1905.

Craterium leucocephalum (Pers.) Ditmar, 1813.
In Studebaker's Woods. July 10, 1905.
Also Bankson Lake. July 27, 1905.

Comatricha irregularis Rex. 1891.
In Studebaker's Woods. July 10, 1905.
Also Bankson Lake. July 27, 1905.

Cienkowskia reticulata (Alb. and Schw.) Rost. 1873.
At St Joseph River
Portage near Notre
Dame, Ind. Rare. Aug. 1905.

Diderma testaceum (Schrad.) Pers. 1801.
At Joseph River Portage.
Quite Common. Aug. 1905.

Diderma floriforme (Bull.) Pers. 1794.
At Bankson Lake. July 27, 1905.

Diderma niveum (Rost.) Macbr. 1899.
In Ravine near St. Mary's
Academy, Notre Dame, Ind. Aug. 1905.

Diderma globosum Pers. 1794.
In Ravine near St. Mary's
Academy. Quite common. Aug. 1905.

Diderma crustaceum Peck. 1871.
In Ravine near St. Mary's
Academy. Aug. 1905.

Diderma cinereum Morgan. 1894.
At Bankson Lake. July 25, 1905.
Also near St. Mary's
Academy. Aug. 1905.

Diderma spumarioides Fries. 1829.
In ravine near St. Mary's
Academy. Aug. 1905.

Diachea leucopoda (Bull.) Rost. 1875.
At Bankson Lake. July 27, 1905.

Didymium xanthopus (Ditm.) Fries. 1829.
At Bankson Lake. July 27th, 1905.

Didymium clavus (Alb. and Schw.) Rabenhorst. 1844.
In Woods along Sumption
Prairie Road, South Bend, Ind. July 10, 1905.

Didymium squamulosum (Alb. and Schw.) Fries. 1829.
In Studebaker's Woods. July 10, 1905.

Dictydium cancellatum (Batsch) Macbr. 1899.
In Studebaker's Woods. July 10, 1905.
Also at Bankson Lake. July 27, 1905.

Dictydium cancellatum var. purpureum (Batsch) Macbr. 1899.
At Bankson Lake.
Very abundant. July 25, 1905.

Enteridium splendens Morgan. 1899.
On Sumption Prairie Road. July 10, 1905.

Fuligo ovata (Schaeff.) Macbr. 1899.
Near St. Joseph's Lake,
Notre Dame, Ind.
Common everywhere and
abundant throughout the season. June to Sept. 1905.

Hemitrichia clavata (Pers.) Rost. 1873.
In Woods south of
Sumption Prairie Road.
Common everywhere. July 10, 1905.

Hemitrichia serpula (Scop.) Rost. 1875.
At St. Joseph River
Portage. Rare. Aug. 1905.

Hemitrichia stipitata Mass. 1889.
At Bankson Lake.
Quite common. July 27, 1905.

Hemitrichia vesparium (Batsch) Macbr. 1899.
On Sumption Prairie
Road. Quite common. July 10, 1905.

Lycogala epidendrum Fries. 1829.
At Bankson Lake.
Also Studebaker's Woods.
Common everywhere. July 10, 1905.

Leocarpus fragilis (Dickson) Rost. 1875.
In Studebaker's Woods. July 10, 1905.

Lamproderma arcyrionema Rost. 1875.
In woods along Sumption
Prairie Road. July 10, 1905.

Mucilago spongiosa (Leyss.) Morgan 1897.
At Bankson Lake. July 27, 1905.

Physarum cinereum (Batsch) Pers. 1801.
University Lawn. July, 1905.

Physarum leucopus Link. 1809.
Near St. Mary's
Academy. Aug. 1905.

Physarum sinuosum (Bull.) Weinn. 1828.
At Bankson Lake. July 27, 1905.
Also at St. Mary's Academy. Aug. 1905.
Also at St. Joseph River Portage. Aug. 1905.

Physarum plumbeum Fries. 1829.
At Bankson Lake. July 25, 1905.

Physarum pulcherrimum Berk. and Rav. 1873.
At Bankson Lake. July 27, 1905.

Physarum ellipsosporum Rost. 1875.
Near St. Mary's Academy. Aug. 1905.

Reticularia lycoperdon Bull. 1791.
On Sumption Prairie Road.
Quite common. July 10, 1905.

Stemonitis fusca (Roth) Rost, 1875.
At Bankson Lake. July 27, 1905.
Also Stukebaker's Woods.
Very Common.

Stemonitis maxima Schweinitz. 1834.
At Bankson Lake.
Common and abundant. July 27, 1905.

Tubifera Casparyi (Rost.) Macbr. 1899.
At Bankson Lake.
Rather Common and abundant. July 27, 1905.

Tilmadoche viridis (Bull.) Saccardo. 1880.
At Bankson Lake.
Common everywhere. July 24, 1905.

Tilmadoche compacta Wingate. 1889.
In Studebaker's Woods. July 10, 1905.

Trichia varia (Pers.) Rost. 1875.
Near St. Joseph River Portage. Aug. 1905.

Trichia persimilis Karst. 1868.
Near St. Joseph River Portage. Aug. 1905.

Department of Botany
University of Notre Dame

The Preparation of Absolute Alcohol for Histological and Chemical Purposes.*

ALBERT T. MERTES.

A cheap and convenient method of preparing absolute alcohol for histological purposes on a small scale in a school or college is much needed. The ordinary methods given in text-books of organic chemistry require a considerable amount of apparatus and many different appliances which an ordinary biological laboratory might not conveniently have, and it is because of this fact that the following method has been devised.

Ordinary commercial alcohol about 90 to 95 per cent. strong is placed in a bottle or flask and small quantities of calcium carbide added at different intervals of time dependant on the rapidity with which the carbide is attacked,—about once in six hours is sufficient; if the mixture be placed in a warm place, however, the action is much more rapid. 125 grams may be added at the beginning of the operation, and 25 grams at a time every 5 or 6 hours thereafter until the reaction is finished. This point may be recognized both by the cessation of the appearance of bubbles of acetylene, or from the fact that the freshly added carbide remains several hours unacted upon.

The carbide acts upon the water in the alcohol, forming slaked lime and acetylene. (Reaction) $CaC_2+2H_2O=Ca(OH)_2+C_2H_2$. When it is dehydrated the action ceases. During the process the mixture should not be shaken or agitated, because the slag or residue of slaked lime becomes suspended in the liquid and settles on the added portions of carbide thus preventing further action. If the carbide is added at different intervals it spreads out upon the spent residue forming a layer that will be acted upon.

When the last layer of carbide remains unchanged after being in contact with the alcohol for some hours, the action is considered complete. If much matter remains suspended in the liquid, the mixture is allowed to stand a little longer till the supernatant liquid is clear and well settled. The alcohol is now carefully decanted or siphoned into a dry bottle and kept therein until used.

* Extract from thesis for the Bachelor's degree in Science. I wish to thank my professor, Dr. J. A. Nieuwland, who suggested the subject of this thesis.

Alcohol prepared in this manner is completely dehydrated but contains as an impurity acetylene gas, some lime in solution, also some traces of organic sulphur compounds. The alcohol though clear may be of a strong yellow color due to these compounds especially so when denatured alcohol is used. This color, however, is not objectionable when the primary end is to obtain an absolute alcohol for histological purposes. The acetylene may be almost entirely removed by warming the liquid to about 75° C. This may be easily accomplished by placing the bottle on a steam radiator for two or three hours till the heat drives the gas out of solution. The acetylene that remains does not affect the reagents nor mounts. The lime disolved is not appreciable, being about 1 part by weight in 30,000 of alcohol by volume. Though this alcohol is not strictly pure, the presence of lime is not deleterious, but on the contrary is beneficial. The alkali appears to fix the dye into the section to be stained so that the color of the tissue does not fade. The reason is that most of the dyes used in staining have basic properties and the color is intensified or made more permanent by an alkali, and the dissolved lime answers this purpose, as already noted.*

Where it is impracticable to use dehydrated alcohol containing lime or acetylene in solution, the alcohol may be further purified by subjecting it to distillation, thus getting rid of the dissolved impurities from the action of the commercial carbide which is rather impure. On account of the solubility of acetylene in alcohol there will be a small amount found in the distillate. This is removed by adding a little finely-powdered and dried silver and mercuric nitrate or mercuric oxide. These salts form compounds with the acetylene and on again subjecting the alcohol to distillation they are eliminated and the distillate is obtained pure and absolute. Mercuric oxide removes sulphur compounds which are liable to be present, since thioaldehydes are almost always formed as a result of the action of an acid on calcium carbide.

Pure absolute alcohol is described as absolutely odorless and the product prepared by this method comes as near to being as free from having any odor whatever, as any we have ever obtained by the methods hitherto described. This fact strongly emphasizes the purity of the alcohol made from carbide according to the directions we have given.

The essential reason why calcium carbide is more efficient for dehydrating purposes, than quicklime is that it acts upon the water

* Midland Naturalist, Vol. 1, p. 28.

in two stages: $CaC_2+H_2O=CaO+C_2H_2$; $CaO+H_2O=Ca(OH)_2$. In the first stage of the reaction acetylene and calcium oxide are formed; and the calcium oxide then unites with more water producing calcium hydroxide. Thus for every molecule of carbide used there are two molecules of water acted upon. Using ordinary unslaked lime we have an agent which is theoretically one-half as efficient as carbide and practically never even half as efficient, since its reaction is the same as the one taking place in the second stage when carbide is used, consequently it has the disadvantage of not being as active in uniting with water as is carbide, and since it absorbs a great deal of alcohol, thereby the distillation from the residue becomes very slow and incomplete.

In an experiment using two liters of alcohol having a specific gravity of .832 or about 90 per cent purity, we obtained 1400 cc impure alcohol such as could be used for dehydrating in methods of histological technique,—the only piece of apparatus used being an ordinary bottle containing the mixture. By distilling the residue or slag remaining after these 1400 cc of alcohol had been decanted, nearly 400 cc more of alcohol absolutely free from water was obtained, thus making the yield almost quantitative. To this distillate were added a few grams of dried mercuric nitrate and some silver nitrate. The mixture was then allowed to stand about a day in a warm place till all the acetylene and other compounds, which are formed due to the impurities in the carbide, were acted upon.

In order to be sure that all the acetylene has combined with the mercury and silver salts, some of the clear liquid was decanted and tested with a small portion of finely powered silver nitrate. Any precipitate or dark coloration which formed on standing indicated the presence of impurities, and necessitated the addition of more mercury and silver salts.

When all the impurities from the carbide were removed, the liquid, after decantation or filtration from the precipitate, was distilled and found to have a specific gravity of .7876 at 25° C. or a purity of 99.8 per cent. The distillate had hardly any odor or a very slight but pure ethereal one, and was practically free from any foreign substance whatever. It is always necessary to free the liquid from any of the precipitates of silver or mercury carbides formed by the action of the acetylene on the purifying salts, for there is danger of their exploding or decomposing when the last portions of the alcohol are distilled.

It required several days to effect the dehydration, and 550 grams of calcium carbide was used. The dehydration may, how-

ever, be accomplished in a much shorter time by boiling with an excess of carbide on a water bath, and using a reflux condenser. Absolute alcohol was made by this latter process in 10 hours.

It was found that the final distillate measured 1600 cc or the yield was equivalent to 89 per cent. of the theory. A larger yield could have been obtained if greater care had been used in obtaining the last traces of alcohol from the slag in the distilling vessel. This yield is much greater than that obtained by any other method now in general use that we have tried, and the ease in which the dehydration is accomplished as well as its completeness, make the carbide method the best one that we have been able to find.

Migration of Birds in St. Joseph County, Ind., from March 1 to May 30, 1909.

B. Alphonsus.

The accompanying observations on the migration of birds was made at Notre Dame, Ind., and immediate vicinity, and unless otherwise stated the dates refer to their arrival.

The condition of the weather always affects the migration of birds northward. In a mild winter, the first arrivals appear here about the middle of February. In 1906, an exceedingly mild winter, I saw a flock of about a dozen robins on the 15th of February; on the 12th of the same month I saw a song sparrow. The full tide of migration, however, seldom sets in for any species before the 1st of March.

During this month a cold wave will check the coming of the birds, making their arrival a week or two later than usual. The same holds good in April. Birds that generally arrive in the last week of April, such as the catbird, purple martin and Baltimore oriole, may not appear until after the 5th of May.

The present spring was notable for cold weather. The first week in March and April the weather was comparatively warm. The remainder of these months it was cool and some days cold. In May up to the 21st the temperature was over 70° only three days. On eight days it was below 60°. The lowest temperature in May was 32° on the 1st of the month. In the evening snow covered the ground.

The dates of the arrival and the departure of birds given in this article were taken from my notebook. A list of all the birds found each day enabled me to know pretty accurately the day a bird was first or last seen.

March	1	Bluebird
"	2	Robin
"	5	Meadowlark
"	6	Song Sparrow
"	7	Purple Grackle
"	9	Killdeer
"	19	Mourning Dove
April	3	Kingfisher
"	3	Phoebe
"	5	Cowbird
"	5	Vesper Sparrow
"	5	Flicker
"	6	Field Sparrow
"	7	Golden-crowned Kinglet
"	10	Chipping Sparrow
"	11	Yellow-bellied Sapsucker
"	13	Hermit Thrush
"	14	Purple Finch
"	17	Brown Thrush
"	17	Towhee
"	19	Hell Diver
"	19	Barn Swallow
"	20	Red-headed Woodpecker
"	20	Red-wingedBlackbird
"	20	Myrtle Warbler
"	20	Cardinal
"	22	Ruby-crowned Kinglet
"	23	House Wren
"	26	Yellow Palm Warbler
"	27	White-crowned Sparrow
"	27	Spotted Sandpiper
"	27	Yellow-bellied Sapsucker departed
May	1	Kentucky Warbler
"	3	Chimney Swift
"	3	Wilson's Thrush
"	4	Brown Creeper departed
"	5	Golden-crowned Kinglet departed
"	5	Purple Finch departed
"	5	Yellow Warbler
"	5	Baltimore Oriole
"	5	Rose-breasted Grosbeak
"	5	Indigo Bird
"	6	Warbling Vireo
"	6	Snowbird departed
"	7	Catbird
"	7	Orchard Oriole
"	8	Kingbird
"	9	Black-throated Blue Warbler
"	11	Goldfinch
"	11	Oven-bird
"	11	Northern Yellowthroat
"	12	Redstart
"	13	Bobolink
"	13	Purple Martin
"	13	Blackburnian Warbler
"	13	Hooded Warbler
"	15	Ruby-crowned Kinglet departed
"	19	Yellow Palm Warbler departed
"	19	Scarlet Tanager
"	19	Bay-breasted Warbler

May	19	Dickcissel	May	27	Crested Flycatcher
"	21	Myrtle Warbler departed	"	27	Blue Grosbeak
"	22	Least Flycatcher	"	27	Cedarbird
"	24	Canadian Warbler	"	28	Wilson Warbler
"	24	Tennesee Warbler	"	28	Yellow-billed Cuckoo
"	25	Alder Flycatcher	"	29	Hermit Thrush de-
"	25	White-crowned Sparrow departed			departed

Notes on the Priority of Plant Names.

J. A. NIEUWLAND.

In the April number of this periodical* several names of plants were found to antedate in publication the year commonly recognized at the present time. It has since been found that still another author published or restored several of these genera at a date earlier even than that stated in the preceding number of the Midland Naturalist. This botanist is J. G. Zinn, and the work in which the plants were published is his "Catalogus Plantarum Horti Academici et Agri Göttingensis," printed at Göttingen in the year 1757.

The following are affected:

1. Taraxacum, Zinn, 1757 (In part), instead of Ludwig-Böhmer, 1760.†

2. Unifolium, Zinn, 1757, instead of Ludwig-Böhmer, 1760.

3. Coronopus, Zinn, 1757, instead of Ludwig-Böhmer, 1760.‡

4. Odontites, Zinn, 1757, instead of Ludwig-Böhmer, 1760.‡

5. The name Epipactis was stated by A. A. Eaton§ to have been first used by Böhmer in Ludwig's 3rd Ed. of the Definitiones Plantarum, 1760. The name was, however, previously published by Zinn, 1757, to designate the aggregate of the Linnaean genus Serapias as limited by A. A. Eaton, and Epipactis proper formerly called Helleborine. Those that follow the rules underlying the "theory of residues" will probably therefore attribute the name to Zinn instead of Böhmer.

* Midland Naturalist, Vol. I., No. 1, p. 18.

† Ludwig, J. G. Definitiones Plantarum, 1760. 3rd Ed, by Böhmer.

‡ Gray's Manual, 7th Ed. 1908.

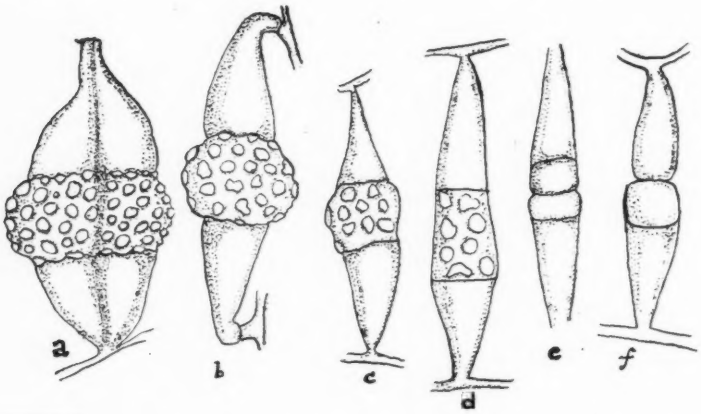
§ A. A. Eaton, Proc. Biol. Soc. Washington, XXI. (1903), pp. 65–68, also Repertorium Spec. Novar. F. Fedde, Vol. VI., p. 40–44.

Mycological Notes. *

GUY WEST WILSON.

I. ZYGOSPORES OF MUCOR STOLONIFER.

In the course of a series of cultures of various species of *Mucor* there was obtained a number of zygospores of *M. stolonifer* Ehrenb. (*Rhizopus nigricans* Ehrenb.) These appeared the latter part of April, in a stender dish culture on a decoction of rye bread. Except for size they were typical of the species; but measured only 80–90 μ, or about one-half the size usually recorded. Innoculations from this culture to bread were made with the results that a good growth of mycelium was formed and numerous gametes produced. From some cause, the nature of which was not determined, very few zygospores were produced, and these were none of them strictly normal. While no cytological study was made, a careful gross examination of the protoplasmic contents of both cultures was made. In the first culture the zygospores were completely opaque, black in appearance, and upon rupture of the epispore a very distinct oil drop was visible. In the second culture, even the apparently matured zygospores in addition to being smaller in size



* The observations upon which these notes are based were made while a student in the laboratory of Dr. J. C. Arthur at Purdue University, La Fayette, Ind.

were less opaque, dark chocolate-brown in color and with the tubercles clearly discernable in the unbroken epispore. The protoplasmic contents were sparse and the oil globules small and numerous. That these were not immature stages is shown by the fact that three or four weeks time produced no change in the culture.

A series of camera-lucida drawings were made of several of the abnormalities found in the culture. The typical zygospore of the species is subglobose and borne between a pair of almost equal suspensors which taper from the spore to the hyphae from which they arise and with which they are continuous. The zygospore represented at figure *b* is normal except in regard to the suspensors which are separated from their hyphae by septae and are sharply curved at the base. Figures *c* and *d* represent types of poorly developed zygospores both of which were very light brown and almost destitute of protoplasm. Figures *e* and *f* represent parthenospores. These are formed by a single gamete and are said to have the same function as the zygospores. The term "azygospore" is usually applied to these spores but with questionable propriety as, being formed without the union of gametes, either equal or unequal, they are certainly not entitled to be called zygospores. Moreover, the term azygospore is not used to designate similar structures among the zygosporic Algae, nor are equivalent spores among the oosporic Algae and Fungi referred to as "anoospores." Figure *e* represents both the gametes as having formed smooth, light colored spores, while in figure *f* but one spore was formed, the other progamete not even cutting off a gamete.

By far the most interesting of these abnormal spores is that illustrated in figure *a*. This spore has the appearance of being double in structure; but at no point were the suspensors entirely separated, although both suspensor and spore were deeply grooved. This abnormality may have been formed by the fusion of closely approximated gametes; or, as is to the mind of the author much more probable, we have here an example of fasciation in the moulds.

II. A Nematode in Hydrogera Kleinii.

While engaged in a study of the local species of *Mucorales* of Tippecanoe County, Indiana, a mass of horse dung which was covered with *Hydrogera Kleinii* (van Tiegh.) Kuntze, (*Pilobolus Kleinii* van Tiegh) was brought into the laboratory the 16th of October. The sporangiophores averaged a centimeter in height and were of a bright yellow color. The spores were large (14–20 μ)

and filled with an abundance of yellowish, granular protoplasm. The mould was of a very healthy appearance and luxuriant growth yet all attempts to germinate the discharged spores failed. The material was set to one side and no further attention given it until the first week in February when it was placed in a moist chamber where a scant growth of mould occurred. The sporangiophores were about 0.5 cm. in height and appeared white to the naked eye. Under the microscope a faint orange tint was apparent. The spores were normal in size but very light in color.

On the 15th the culture was reexamined to note the difference between the earlier and the later sporangia of the same growth. Only a few sporangia remained. Instead of the usual beautiful crystalline objects they had much the appearance of a large *Aspergillus*. Under the microscope the majority of the sporangia appeared as distorted masses of spores without trace of the sporangial membrane or of the subsporangial swelling. A single specimen was still intact, yet the subsporangial swelling was convulsed by an internal disturbance so that its form was constantly changing. It soon burst, six small worms emerged, and the sporangium took upon itself the same appearance as the others. The spores of these infested sporangia were only about 2–4 μ in size, colorless and apparently empty. They also exhibited a decided tendency to arrange themselves in chains of one or two rows of spores—a characteristic which I have not noticed in the normal spores. After the mass of spores had been washed away the effect on the sporangiophore was apparent. In escaping the worms broke the walls of the subsporangial swelling in such a way as to prevent the discharge of the sporangium and to allow the swelling to collapse somewhat, leaving the apex of the sporangiophore club-shaped.

The worms were minute, colorless, about 25–39 μ thick and 600–800 μ long. Under a high magnifying power the internal structure appeared rather distinctly and the organs could be traced with considerable satisfaction. The worms are enclosed in a transparent, colorless perisarc from which the body is entirely free. Anteriorly the worm is blunt and rather rounded with a distinct gullet. Posteriorly the perisarc is produced into a long tapering point far beyond the pointed posterior extremity of the worm. In motion the perisarc is very perceptably wrinkled but the body of the worm has no such appearance.

In Coeman's * Monographie du Genre Pilobolus (p. 49–52), we find an account of the sporangiophores of *Pilolobus crystalinus*

*. Mem. Cour. l'Acad. roy. Belg. XXX. 1861.

and *P. oedipus* being infested by a Nematode which he called *Rhabditis terricola* Duj. The form according to Coemans, is common in decaying substances and not of rare occurrence in the above named species. He cites references to previous observations upon the subject by Persoon,† Currey,‡ and Ehrenberg§. Illustrations of the worm and its work supplement the text‖ and lead to the conclusion that the species under observation is identical with that studied by the older authors.

Material from this culture was sent to Dr. C. W. Stiles of the Public Health and Marine-Hospital Service for identification. He reported that only larvae could be found and as no adults developed after a considerable period of observation he concluded that the species was parasitic upon the horse.

The papers cited above contain a discussion as to the relation of the worm to the fungus but only conflicting conclusions are reached; nor have we any theory to advance to explain the occurrence of the worms within the sporangiophores of the mould.

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†. Obs. Myc. 1:77. 1796.
‡. Jour. Linn. Soc. London 1:166.
§. Kuntze and Schmidt, Myk. Hefte. 2:67. 1823.
‖. Pl. 11. A 19, C, D.

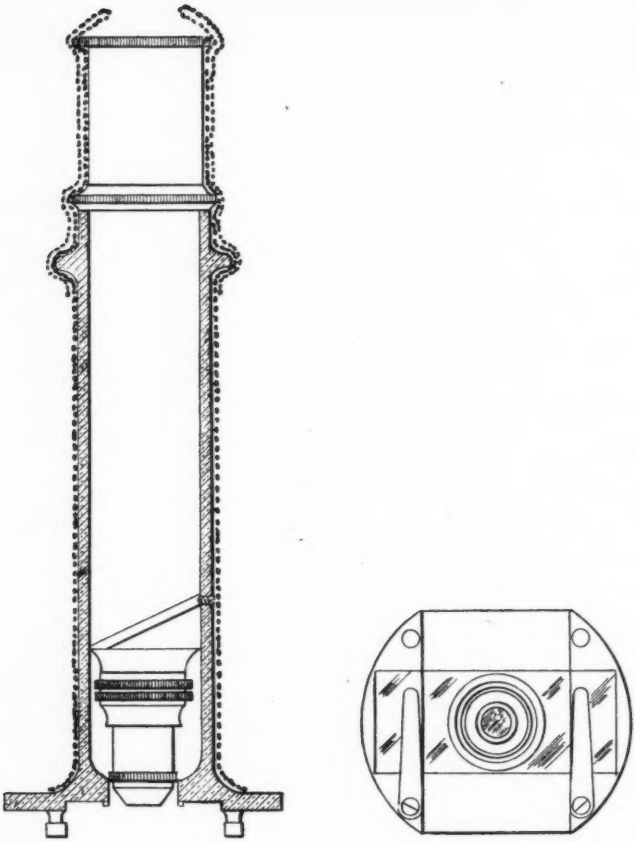
Microscopy Notes.

II. A Convenient Field Microscope.

By Joseph A. Martin.

The ordinary type of instrument advertised by optical companies, as a compound field microscope, such as designed to collect microscopic plants has many objections to its adoption for general use, especially because they are expensive and inconveniently constructed.

In gathering material or objects, such as algae, it is very essential for one to know whether or not the material is in favorable condition before leaving the field; for if left to be examined in the laboratory later and then found to be worthless loss of time results. On returning the following day it is not likely that one will find the



plants in the same stages of development, even after so short a time. An instrument then, that would have simple and effective workings would save much time and unnecessary trouble in gathering and examining or observing very minute objects. Then again, the best specimens of algae are oftentimes found where the ordinary field microscope, with its fittings so complicated, as though it were a laboratory instrument, is difficult to be used. It is really necessary that the different stages of plants be recognized before the collector leaves the field.

The accompanying illustration represents the contrivance one-half size, now used by the collectors of the University in gathering

and examining material in the field. This device is simply a modified demonstration microscope used in class examination of objects. The handle usually seen attached to the apparatus in the optical catalogues, is left off and the base is cut down to a narrow circular outline, so as to fit easily into the collector's pocket. A piece of Gooch tubing is stretched over the brass fittings of the instrument, to protect it from the corrosive action of the water and dirt. The ocular may be protected by a rubber cap and the objective is always kept from injury by the thick slide securely held by two clamps. The lenses most convenient are found to be either a two-thirds objective, with a wide aperture, and one inch or one-half inch ocular, or a one-half inch objective with a one inch ocular. Any higher power of objective combination than those indicated, was found difficult to focus, as there is no micrometer adjustment, and if one were present would be very inconvenient to work. A one-fourth inch objective was used but was discarded owing to the fact that it could not be rapidly brought to focus.

In making an examination, a small amount of the material is put on the outside of the slide, then held up to the light and by turning the tube may be focused. If a drop of water is examined for unicellular plants, the microscope may be held downwards to the reflection of the light of the sky from the water. A cover-glass is very desirable, though it is never really necessary except with unicellular forms.

Experience has shown that it is hardly ever necessary to use a combination higher than a two-thirds-inch objective, and a one-inch ocular. Such difficult material as conjugating desmids 13 to 15 microns in diameter were clearly and conclusively demonstrated with the combination just mentioned and this is about the smallest specimen likely to be gathered in ordinarily field work. The wider the aperture of the objective the better results will be attained, owing to the fact that the wide aperture takes in a broader field. The usefulness of the instrument as a demonstration microscope is not impaired in the least, and the handle can be replaced in a few moments. The type for field use is always kept nearly in focus by the Gooch tubing which is doubled on itself near the eye-piece to obviate wear on the milled parts of the microscope. Its simple construction makes it easy for students to use it with little danger or injury and all working parts are so thoroughly concealed that it is practically impossible for dust and dirt to penetrate.

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Book Reviews.

A New Booklet of Botany. *

Comparing this with other recent books on the same subject, one might with perhaps equal propriety designate it a Booklet of New Botany; there is so much of newness and originality in it, and this notwithstanding that the plants dealt with are for the most part old, and presumably well known.

The title, Elysium Marianum, is not a title of the condescending sort; that is to say, the unlettered will not know by the booklet's mere title, that it treats of plants, and is therefore a booklet of botany. Only the really educated and cultivated mind will readily infer that Elysium Marianum will prove a treatise on the delightsome woodland and meadow and park and wayside denizens of Maryland; and it is a new thing, almost, in modern botany, for an author to emphasize, in the title of his book, not the science itself, but rather, the exalted pleasure and refined delight which the pursuit of botany enkindles in the soul of every one who, having given both mind and soul much and careful culture, betakes himself to the study of plant life and form. All this, which the Latin title itself suggests, comes out clearly and explicitly, in English, in the brief Preface that introduces the first Part; and at the foot of these prefatory notes alone, by the way, and not on the title-page, does the author's name appear.

This introductory issue of the Elysium is of 96 pages supplemented by 12 fine plates. The first Part treats of the ferns and fern-allies of Maryland and Virginia; the second of the coniferous trees and shrubs of the same region. And while the title and the preface, as we have said, promise somewhat of the aesthetic in the treatment of things, yet this turns out to be something altogether different from, and in reality far above the merely popular account of the plants and trees taken under consideration. While giving in after paragraphs and elsewhere full expression to pleasing thought and lofty sentiment, the first thing everywhere is the accurate scientific account—the rigid morphologic diagnosis—of the plant or tree; the statement of the several marks by which the really

* Elysium Marianum, Washington, D. C., Part I, 1907; Part II., 1908. [Ivar Tidestrom.]

trained botanist may identify to a certainty the genus and species; and then its Latin name—its universally received scientific name—is given; all this quite as in the most dry and exclusively technical of books. Just this dry diagnosis, however, is one of the prime necessities of a good book of botany; that is, of botany that is not meant for the unbotanical, but for botanists. Let not this be overlooked. But still, it is not needful that a booklet about plants should both begin and end with mere plant description; and Mr. Tidestrom most happily demonstrates this; and it is in the demonstration of it that the ELYSIUM excels—and very far excels—all ordinary and familiar books in which plants are described.

For an example, let us review the Elysium's presentation of *Adiantum pedatum*, one of the most admired of North American ferns, as well as one of the most familiar among them; a plant commonly known to the unbotanical among us as the Maidenhair Fern.

The topic is introduced by the Graeco-Latin or scientific plant-name ADIANTUM; and this quite as one finds it in any and every book of systematic botany. It is the name of the genus—that is, of the whole assemblage of the so-called maidenhair ferns. Now printed on the same line with this name ADIANTUM in almost all books of scientific botany one reads an L. or the abbreviation Linn., which is always understood to signify that Linnaeus, the most noted botanist of the eighteenth century, founded this genus ADIANTUM and gave it that name. Our author declines to write either L. or Linn. after this generic name, but puts there the abbreviation Theophr. instead. And only to the uninstructed will this substitution of Theophr. in place of the conventional Linn., or L., seem a small matter. But any real master of botanical science at once perceives here the author's claim that not Linnaeus but Theophrastus is author of the generic name ADIANTUM. Theophrastus, the father of scientic botany taught publicly, and wrote an immortal treatise on it some 250 years before the Christian era. In that he has an account of the genus adiantum, and under that selfsame name. The upshot of all this is, that not only is Linnaeus not to be credited with adiantum; the genus was so known and so written upon by all botanists during all of two thousand years before him. To Mr. Tidestrom's mind evidently to credit Linnaeus with ADIANTUM is to intercalate a children's fable into the midst of a page of science, and that not *as a fable*, but as if it were the truth. The scientific mind—the mind that is in love with science—is in love with the truth, and naturally demands of science that it shall

in its every written page, and paragraph, and period, conform to the truth. Not one falsehood, which he has found to be such, can be admitted to his page. No ecumenical conclave of the world's botanical authorities, by their vote favoring falsities, can receive from the botanical truth-lover a moment's consideration. Though almost all the botanical books of the last hundred years assert that Linnaeus founded the genus ADIANTUM, and almost all botanical authorities of to-day will anathematize the daring man who eliminates from his booklet that and all falsehoods like it, the truth-lover—who alone is the truly scientific man—writes down the truth, spurning the untruth however often reiterated and almost superstitiously venerated. ADIANTUM, the fern genus, dates not from Linnaeus and 1753, but from Theophrastus Eresius, who ended a glorious botanical career just about twenty centuries before Linnaeus was born. It ought to seem—perhaps a few centuries hence, if not even a few score years from now it may seem—to have been a strange condition of things, that in the beginning of the twentieth century the falsifying of the history of plant-genera, and of plant names, should have been so almost universally practiced and approved, as virtually to bring maledictions on the head of any botanist who, knowing and respecting the truth about such matters, should dare however quietly and unostentatiously to promulgate it.

To have devoted so many paragraphs to this typical example of generic nomenclature in the booklet before us requires no apology. The whole subject is, and for years has been, too prominently before the botanical systematists of every land. And I am the more cogently impelled to a clear setting forth of the opinions of this writer by the fact that ostensibly, in the meditation of these supposedly intricate questions he has come out into the open daylight—has reached an advanced point attained by few—where no need is realized of so-called codes, the labored product of associations and congresses who seem to but scratch over the mere surface of the whole question, and deal with matters of present expediency to the utter ignoring of eternal principles. Mr. Tidestrom's position on generic nomenclature refreshingly recalls that one expressed by the late Professor H. Baillon of Paris, when he said that the only principle of nomenclature worth any consideration is that of historic priority; a principle which every conclave of botanical nomenclators that has met in recent years has voted to ignore.

Books of descriptive botany, even the conventional and the mediocre, are apt to give parenthetically after each Latin- or Greek-made generic name, some explanation real or supposed of the names

meaning; but these etymologies, commonly but guessed at—or more commonly pirated from some other author—are often most improbable, and not rarely absurd or ridiculous. Of these failings of hasty and slip-shod botanical etymologists the author of the Elysium is well aware. Also the explanations, where he produces them, are found worthy of a better than parenthetic placing; and he presents them not in his own language, but precisely that of the author who made the name; and this not only as a matter of scholarly discretion, but in justice to authors themselves; for the writer of the Elysium seems to hold piracies in abhorrence. Here is the classic explanation that he reproduces for the classic Greek ADIANTUM: "*Adianton autem ex eo dicitur, quod folium, ut Theophrastus ait, non madescat: Dodonaeus*, 1583. Stirp Hist. 466. There is in these reproduced etymologies no condescension to modern botanical illiteracy. He will not turn them into English. The even half equipped botanical taxonomist, even of this twentieth century, knows Latin. So also if the founder of a genus has explained the name of it in French, in German, or in Italian, the author of the Elysium does not translate it. He means his booklet for the tolerably well educated only.

Passing over the formal diagnosis of genus and species and this bibliography of the latter, all of which are accurate, yet also brief, as they should be, we present in its entirety the concluding Adiantum paragraph. It occupies about as much space as all the onomastic and diagnostic paragraphs combined.

"The leaves of *A Capillus Veneris* have been used in medicine from time immemorial; they are known in pharmacy as *Herba Capillorum Veneris s. Folia Capilli*, and were used in making a syrup (*Syrupus Capillorum*)."

This appears to me to be Mr. Tidestrom's own writing, and relates to the more southerly of the American species of genus; but the following he has taken from another author.

"*Adiantum pedatum* (see Linn. Spec. p. 1095) was also one of the plants in which a flourishing trade is carried on by Canada. Cornut in his Canadens. Plant. Hist. p. 7, calls it *Adiantum Americanum*; it is also described and illustrated on page 6. In Canada the plant is usually called *Herba capillaris* and *Maidenhaire* by the English in their colonies. It grows in abundance in all the Englishe provinces through which I have journeyed. It is just as frequent in Southern Canada, but I have never observed it about Quebec. It thrives especially in shady forests and rather rich soil. Several people in Albany and in Canada told me that its [leaves]

were much used instead of tea against consumption, coughs and all diseases of the lungs. They have learnt this from the savages who have used this for these purposes from time immemorial. . . . . The savages went about in the woods in great numbers, journeying for above Montreal searching for this plant."

Translated from Kalm's Res. Nor. Am. 3: 338. 1761.†

There are twenty other genera each of which might as well have been selected for comment as this classic one called *Adiantum*. A glance at any one of them reveals a character and quality in this booklet that make it, at least for this present time, unique, also praiseworthy beyond all that we have tried to say; and the botanists are, after all, perhaps not few, who will eagerly expect the future instalments of a primer of local botany that is so accurate, so simply honest and true in every detail, and withal so erudite.

EDWARD L. GREENE,

† Elys. pp. 27, 28.

CARTERIUS BOTH A SYNONYME AND HOMONYME.—A. M. KIRSCH.

Since the article on Fresh Water Sponges was sent to the press, it has been found that apart from the fact that the name, *Carterius*, Potts, 1887, is a homonyme, it does not even enjoy priority, as is evident from the following dates of *publication*. The specific name of several sponges of the genus must be changed according to all reasonable rules of nomenclature. When Potts changed the homonyme, *Carterella* to *Carterius* he made "confusion more confounded"; for *Carterius* is still a homonyme to *Carteria*. Changing the gender of a Latin name does not make it a new name.

Dosilia Dybowski, 1884.
(*Carterella*, Potts and Mills, 1881.)
Not *Carterella*, Zittel,, 1898.
(*Carterius* Potts, 1887.) (!)
Not *Carteria*, J. E. Gray, 1835.

1. *Dosilia Stepanowii* Dybowski, 1884.
Carterius Stepanowii (Petr.) Potts, 1888.
2. *Dosilia tubisperma* (Mills),——
Carterius tubisperma Mills, 1881. (!)
Spongilla——Mills, 1880.
3. *Dosilia latitenta* (Potts),——.
Carterius latitenta (Potts), 1881. (!)
4. *Dosilia tenosperma* (Potts), ——.
Spongilla tenosperma Potts, 1880.
Spongilla tenosperma Potts, 1881.
Carterella tenosperma Potts, 1881.
Carterius tenosperma Potts, 1887. (!)